DRAWING AMENDMENTS

Replacement sheets of drawings are submitted herewith that contain Figs. 9A, 9B, 11A and 11B amended as follows:

Fig. 9A is amended by removing the reference numerals 24a and 24b;

Fig. 9B is amended by removing the reference numerals 24a and 24b, and by replacing reference numeral 22b with 22a;

Fig. 11A is amended by removing the reference numerals 24a and 24b; and

Fig. 11B is amended by removing the reference numerals 24a and 24b, and by replacing reference numeral 22b with 22a.

REMARKS

Claims 1-8 are pending in the application and are rejected. Claims 9-13 have been canceled. The title of the application and the drawings are objected to.

Information Disclosure Statement

The Applicants thank Examiner Band for his comments regarding the disclosure of references that name the inventors of the present application. An Information Disclosure Statement is submitted with this response that cites the U.S. patent application publication mentioned in the Office Action as well as two other pending U.S. patent applications.

The Office Action indicates an "information disclosure statement filed 3/26/2009 fails to comply with 37 CFR 1.98(a)(2)" because it did not include a copy of one or more non-patent literature publications. The Applicants are not aware of any IDS that was filed on the specified date but an IDS was filed on 3/29/2006 when the application was first filed. Perhaps the Office Action refers to this IDS.

This particular IDS disclosed three non-patent literature publications. The Applicants understand from the Office Action that all disclosed references have been considered. If this is not correct, the Applicants request that the next communication identify those publications not yet considered so that they can provide copies or correct other defects to have them considered.

Specification

The title is objected to for not being descriptive of the claimed invention.

In response, the Applicants amend the title as shown above and request reconsideration.

Drawings

The drawings are objected to because reference numbers 24a, 24b and 22b are not mentioned in the specification.

In response, the Applicants submit replacement sheets that amend Figs. 9A, 9B, 11A and 11B as explained above. Additional sheets are provided that show changes marked in red.

Claim Rejections Under § 112

Claims 4-8 are rejected under 35 U.S.C. § 112, second paragraph, for being indefinite. The Office Action indicates it is unclear what defines the "plane of projection" recited in claims 4-5 and that this term lacks an antecedent.

In response, the Applicants submit new claims 16-17 and request reconsideration.

Rejection of Claim 1 Under §§ 102, 103

The present invention is directed toward a method that irradiates a solid surface with a gas cluster ion beam (GCIB). The claims refer to a radiation incident angle measured between the GCIB and the surface, which is restricted to be less than thirty degrees.

Some of the cited prior art refers to an angle that is complementary to the angle recited in the claims, which is the angle between a GCIB and a normal to the surface. The following remarks refer to both angles but with enough detail that it is believed it is clear which angle is referred to.

Overview of The Following Remarks

The Office Action rejects claim 1 over three prior art references. These references are referred to below as Matsukawa, Kitani and Hoehn. The Applicants respond essentially as follows:

(1) the rejection over Matsukawa should be withdrawn because it relies on an interpretation of Matsukawa that is not correct and that would not be adopted by a person of ordinary skill in the art because it contradicts other known prior art;

(2) the rejection over Kitani should be withdrawn because Kitani does not anticipate the claimed subject matter and does not render it obvious since Kitani teaches away from what is claimed; and

(3) in view of Hoehn, claims 1-8 are canceled and new claims are submitted with a request for reconsideration as explained below.

Hiramoto (Matsukawa)

Claim 1 is rejected under 37 C.F.R. § 102(a) as being anticipated by WO 03/001614, which the Office Action indicates is equivalent to U.S. patent application publication no. 2004/0086752 ("Matsukawa"). Because the body of the discussion in the Office refers to Matsukawa rather than Hiramoto, the remainder of this response refers to Matsukawa.

The Office Action indicates Matsukawa "discloses surface roughness can be suppressed … with ion milling at a low angle or irradiating with a gas cluster ion beam, where the … angle of incidence of the ion beam at the surface is 5° to 25° and is capable of having an angle of incidence between 0° and 90°" (citing paragraphs [0005] and [0034]).

The Applicants do not understand how paragraph [0005] is relevant and have not provided any other comments with regard to this text.

Regarding paragraph [0034], the Applicants submit that the Office Action does not correctly describe what a person of ordinary skill would understand from this text. We believe the following remarks show a person of ordinary skill would have understood Matsukawa differently.

As an initial observation, it may be helpful to point out that Matsukawa does not allege or even suggest that it is disclosing anything new in the use of ion beams to smooth a surface. The principal teachings in Matsukawa pertain to a magnetoresistive element that has improved magnetoresistance characteristics (see Abstract). Matsukawa discloses the use of an ion beam as merely a conventional step to smooth a surface.

Paragraph [0034] in Matsukawa reads as follows:

> The surface roughness of the underlying film can be suppressed by ion-milling the surface at a low angle or irradiating it with a gas cluster ion beam. The ion beam irradiation may be performed so that the angle of incidence of the ion beam at the surface of the underlying film is 5° to 25°. Here, the angle of incidence is 90° when the ion beam orients perpendicular to the surface and is 0° when it orients parallel to the surface.

We focus on the first two sentences in this paragraph.

First Sentence

The first sentence states surface roughness of an underlying film can be suppressed by:

- ion-milling the surface at a low angle or
- irradiating it with a gas cluster ion beam.

The person of ordinary skill in the art understands that this first sentence refers to two different types of ion beam radiation. The first type is "ion milling" that irradiates a material with a beam of individual atomic or molecular ("monomer") ions. The second type irradiates a material with a beam of clusters of atomic or molecular ions.

These two types of ion beam radiation have very different characteristics. For example, please see the last paragraph on page 256 of Yamada et al., "Materials processing by gas cluster ion beams," Materials Science and Engineering R34 (2001), pp. 231-295. (This reference was disclosed in Information Disclosure Statements submitted March 29, 2006 and September 11, 2007).

The first sentence in paragraph [0034] of Matsukawa explains that monomer ion beams may be used at a low incidence angle. The first sentence does not indicate anything about what angle of incidence should be used for a gas cluster ion beam.

Second Sentence

The second sentence in paragraph [0034] states the following:

> "The ion beam irradiation may be performed so that the angle of incidence of the ion beam at the surface of the underlying film is 5° to 25°."

This second sentence is either ambiguous or can be misleading if it is interpreted within only the context of paragraph [0034] alone. There are three possible interpretations:

(1) the term "ion beam" refers to both monomer and cluster ion beams;
(2) the term "ion beam" refers only to a cluster ion beam; or
(3) the term "ion beam" refers only to a monomer ion beam.

The Applicants respectfully submit that a person of ordinary skill in the art would understand that this second sentence refers only to monomer ion beams. This conclusion is supported by the full context of the Matsukawa disclosure as well as what was known and understood in the art at the time the Matsukawa reference was filed (October 2003).

State of the Art in October 2003

The Applicants believe the Yamada et al. reference accurately represents what was known in the art about the effects of irradiation incidence angle on smoothing by monomer and cluster ion beams. The Applicants are not aware of any art that teaches a contrary view. (The Applicants acknowledge the Hoehn reference was part of the state of the art and discuss below why it also did not teach a contrary view.)

It was and is still well known that the smoothing effect of monomer ion beams can be very poor for normal angles of incidence but improves as the angle of irradiation departs away from normal incidence. For example, see Yamada et al. mentioned above, and Panin et al., "p- to n-type Conversion in GaSb by Ion Beam Milling," Appl. Phys. Letters, vol. 67, no. 24, Dec 1995, pp.3584-3586 submitted herewith in an Information Disclosure Statement.

The smoothing properties of monomer ion beams and gas cluster ion beams (GCIB) are different. According to Yamada et al. and all other known art, the smoothing effect achieved by GCIB is maximum for normal incidence and degrades as the irradiation angle departs from normal. See section 4.1.2 on pages 256-259 and section 4.3 on pages 266-273. (Yamada refers to an incidence angle that is complementary to the angle defined in Matsukawa.; therefore, Yamada et al. indicates the smoothing effect of GCIB degrades as the irradiation angle defined in Matsukawa decreases to thirty degrees.)

Fig. 47 on page 270 of Yamada is reproduced below. It illustrates the effect that the incidence angle has upon the smoothing effect of GCIB. Similar effects are illustrated in other figures and discussed in the Yamada reference.

The Applicants respectfully submit that the prior art taught smoothing surfaces by GCIB only at normal or near normal irradiation angles. Yamada et al. as well as other prior art teaches that the smoothing effect becomes progressively worse as this irradiation angle decreases to thirty degrees as measured from the surface. Yamada et al. does not discuss the smoothing effect of irradiation angles smaller than thirty degrees. The Applicants are of the opinion that the authors of

Yamada et al. must have concluded that using even smaller angles would yield even worse results and chose not to study the effects of using even smaller angles. This view is also disclosed in the Kitani reference discussed below.

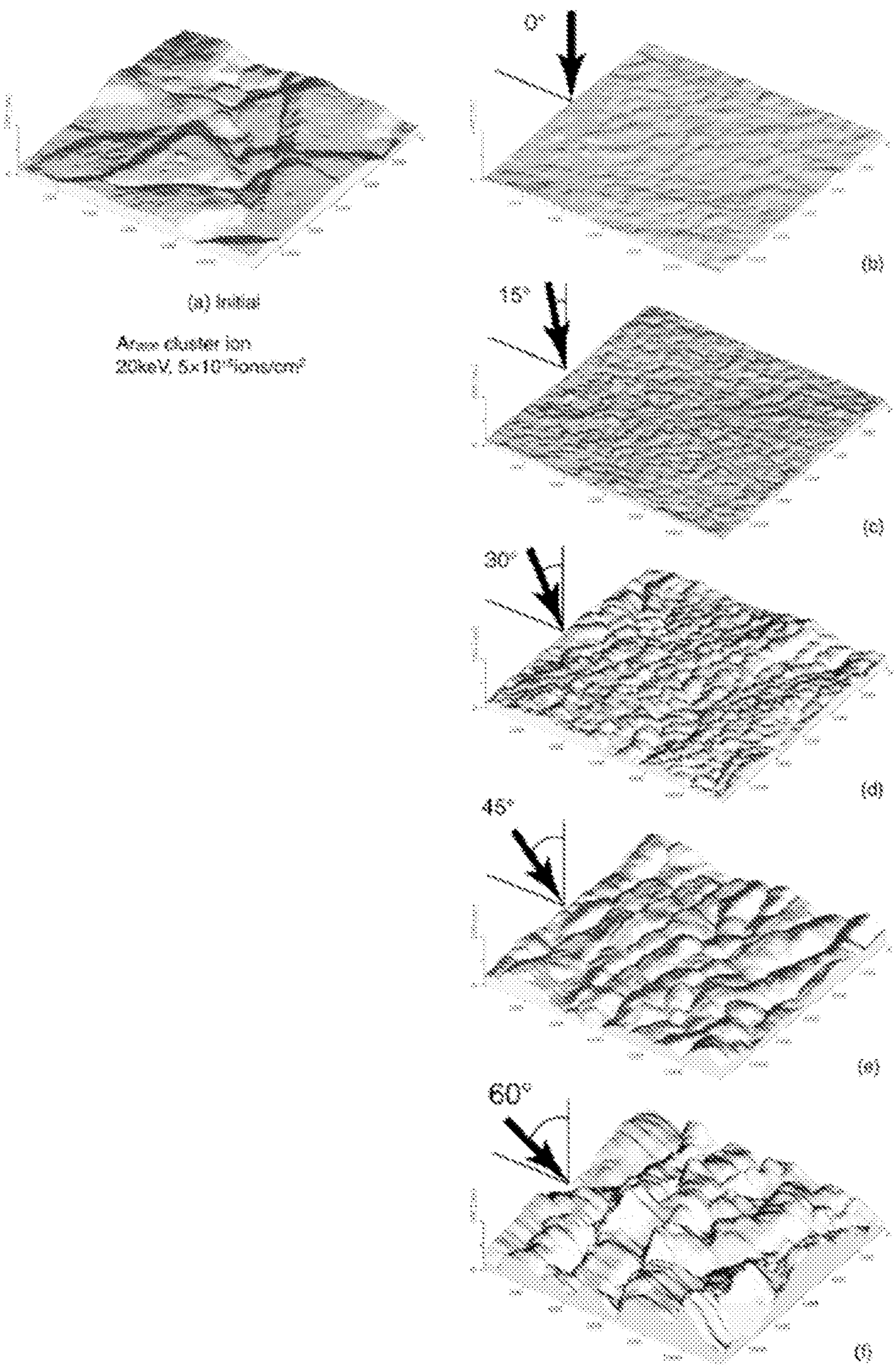


Fig. 47. AFM images of Cu surface irradiated with Ar cluster ions at various incident angles from 0 to 60°.

Referring again to the observation that Matsukawa does not allege or even suggest that it is disclosing anything new in the use of ion beams to smooth a surface, it would be a very remarkable thing indeed if Matsukawa had intended to disclose something contrary to the prior art without at least some explanation, clarification or justification. There is nothing of the kind.

The Applicants therefore believe the second sentence in paragraph [0034] was not intended to refer to GCIB and they respectfully submit that the person of ordinary skill in the art would have understood this second sentence refers only to monomer ion beams or so-called ion milling.

This conclusion is consistent with the remaining disclosure in Matsukawa. For example, paragraph [0072] describes small radiation angles for only a monomer ion beam. Matsukawa does not disclose any example or embodiment that uses GCIB at so-called low angles.

All known prior art including Hoehn discussed below is consistent with this conclusion.

The Applicants respectfully submit that a person of ordinary skill in the art would have understood paragraph [0034] in Matsukawa to disclose only conventional ion beam smoothing, which is either by a monomer ion beam at a small incidence angle or by a cluster ion beam at a conventional angle, which is normal or near normal incidence.

Based upon what the Applicants regard as the correct teaching in Matsukawa, they traverse the rejection of claim 1 because Matsukawa does not teach all elements of the claim.

Kitani

Claim 1 is rejected under 37 C.F.R. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Kitani et al., "Incident angle dependence of the sputtering effect of Ar-cluster-ion bombardment," Nuclear Instruments and Methods in Physics Research, 1997, pp. 489-492 ("Kitani").

Examiner Band brought Kitani to the attention of the Applicants' representative during a telephone interview following the first office action on the merits. As a result, the Applicants had an opportunity to submit arguments in their communication of October 8, 2010 explaining why Kitani does not anticipate or render obvious what is claimed. The present Office Action indicates those arguments were not persuasive.

The Applicants respectfully maintain those arguments. Kitani does not anticipate what is claimed and teaches away from what is claimed.

With regard to anticipation, the Office Action correctly indicates that Kitani discloses the use of radiation incident angles that range from zero degrees to sixty degrees from normal. Thus,

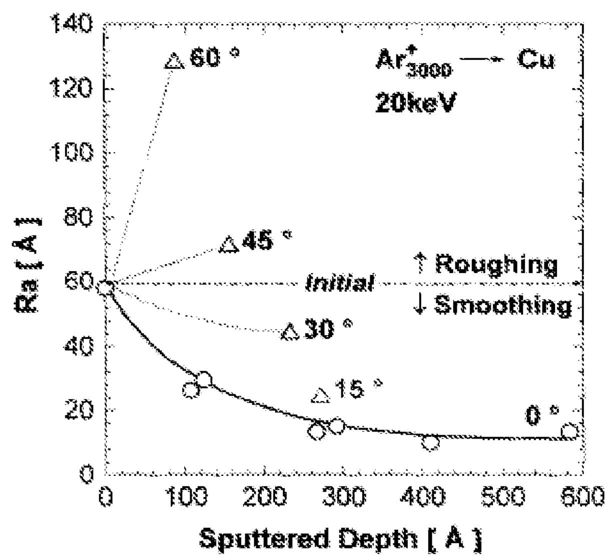
the Office Action acknowledges that Kitani does not disclose a range of angles that either overlaps or touches the range that is claimed. As a result, the rejection under § 102(b) should be withdrawn.

With regard to obviousness, the Office Action argues that "Kitani also discloses that larger angles than 45° can be used since the desired smoothing effect is dependent on the incident angle, thus the angle used for the smoothing effect is a result-effective variable" (emphasis added).

The Applicants respectfully traverse this line of argument. Whether something can be used is not the relevant inquiry for patentability. Instead, the relevant inquiry should determine what would have been obvious to a person of ordinary skill in the art. The Applicants refer to their previous arguments for supporting details and respectfully submit that Kitani teaches away from what is claimed. Referring to the last paragraph of section 3 on p. 491, Kitani states the following:

> "… For larger incident angles than 45°, the roughness increased with the amount of irradiation. It is clear that the smoothing effect of cluster ion bombardment is strongly dependent on the incident angle." (emphasis added)

Fig. 3 on page 491 in Kitani also shows that the initial roughness of a surface increases for incident angles equal to or greater than forty-five degrees, and increases dramatically for angles greater than sixty degrees, which is the range of angles that is claimed.



It is difficult to imagine a reference that could better support the lack of obviousness of what is recited in claim 1.

The Office Action further states that it has been "held that a particular parameter must first be recognized as a result-effective variable … before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation" (citing MPEP 244.05, Section II, Part B).

The Applicants respectfully submit that the Office Action refers to a section of the MPEP that is not applicable to the present situation and it mis-applies the law stated therein. The text in the MPEP that is referred to pertains to work that is deemed to be routine experimentation because it optimizes something <u>within</u> prior art conditions. As noted above, the claimed range of angles lies outside of the range that is disclosed in Kitani and, furthermore, is within an untried, untested range that empirical evidence clearly suggests will not work.

Kitani and other prior art teach away from what is claimed. According to Kitani, if the radiation angle is greater than 45° as measured from the normal, roughness increases. Kitani indicates this effect increases more rapidly with further increases in angle. If the skilled person wanted to smooth something, there would be no obvious reason to try angles larger than 45°. Kitani et al. tried some of these larger angles and reported very clearly that roughness increases.

<u>Hoehn</u>

Claim 1 is rejected under 37 C.F.R. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over U.S. patent application publication no. 2002/0001680 ("Hoehn").

In response, the Applicants cancel claims 1-8, submit new claims 14-21 reciting features that correspond to features recited in some of the dependent claims 2-8, and submit claims 22-24. These claims are discussed below. Support for these claims may be found in the original claims as well as in at least paragraphs [0041] to [0052] and [0066] to [0090] in the published application.

<u>Rejection of Dependent Claims Under § 103</u>

Claims 2-8 are rejected under 37 C.F.R. § 103(a) as being unpatentable over Matsukawa in view of U.S. patent 6,624,081 ("Dykstra"), Matsukawa in view of U.S. patent 7,064,927 ("Erickson"), Kitani in view of Dykstra, Kitani in view of Erickson, Hoehn in view of Dykstra and Hoehn in view of Erickson.

Claims 2-8 are canceled as mentioned above; however, new claims 14-21 recite features that correspond to some of the features recited in claims 2-8. With respect to the new claims, the Applicants respectfully submit that these claims are not anticipated or rendered obvious by a combination of prior art that relies on either Matsukawa or Kitani because all of these claims comprise the limitations of claim 1 and not all limitations of claim 1 are taught by Matsukawa and Kitani as discussed above. In addition, the art used in combination with these two references does not teach the claim limitations alleged in the Office Action as explained below.

The remaining comments are directed to Hoehn, Dykstra and Erickson.

Claims 2-3 (New Claims 14-15)

The Office Action indicates Dykstra and Erickson disclose the features of claims 2-3 that are not recited in the principal references (Matsukawa, Kitani and Hoehn), and that it would have been obvious to combine teachings to obtain all that is claimed. The Applicants disagree.

New claims 14-15 correspond generally to claims 2-3.

The method of claim 14 comprises step (a) that irradiates a solid surface with GCIB at an irradiation angle equal to or greater than 30°, and step (b) that irradiates the solid surface at an irradiation angle less than 30°.

The method of claim 15 comprises step (a) that irradiates a solid surface with GCIB at an irradiation angle less than 30°, step (b) that irradiates the solid surface at an irradiation angle equal to or greater than 30°, and step (c) that repeats a continuous change in irradiation angle.

The use of two or more irradiation angles that are equal to or greater than 30º and that are less than 30º is not disclosed or suggested in either Dykstra or Erickson, and neither reference discloses the continuous change in irradiation angle as claimed.

Dykstra

Dykstra discloses an apparatus in which a GCIB is deflected by some angle or "offset" onto a substrate to be etched. Unwanted ionizing radiation is allowed to propagate along the original undeflected path. This arrangement eliminates harmful ionization on the surface of the substrate.

Referring to page 14, the Office Action characterizes Dykstra as teaching a "GCIB initially directed along a preselected axis where said GCIB is directed offset from the preselected axis" and that "while an example of the offset angle is 15º from the preselected axis (i.e. GCIB hits the substrate at an angle of 75º), other larger angles than 15º may be used."

The Applicants respectfully submit that the angles referred to in the Office Action do not pertain to the angle of incidence with respect to the surface of a substrate that is irradiated by the GCIB. The Applicants are unable to find anything in the text of Dykstra that discloses any incidence angle as measured with respect to the substrate surface.

The Office Action indicates that the 15º degree angle disclosed in Dykstra represents a GCIB that "hits the substrate at an angle of 75º." The Applicants respectfully submit that this is not correct. Dykstra states the substrate to be etched is "positioned in line with the offset gas cluster ion beam." (see col. 3 lns. 52-53). In view of what was known in the art, this statement does not suggest any angle of incidence relative to the surface that is other than conventional normal incidence.

The Office Action further indicates that Dykstra discloses using different angles. What is actually disclosed differs from what is claimed in at least two respects: (1) the angle disclosed in Dykstra does not refer to angle of incidence as explained above, and (2) the use of different angles refers to *a priori* choices that remain fixed or unchanging during GCIB irradiation. The only variation is that which is needed to scan the beam in a raster pattern as is done in other GCIB apparatuses. This tiny variation is referred to as the "scan angle" in Dykstra and is used in conventional apparatuses to direct a GCIB in a raster pattern onto a surface with essentially normal incidence. In contrast to what is disclosed, the claimed methods changes the angle of incidence to vary on either side of 30º from the surface.

Erickson

Erickson discloses a conventional apparatus in which a GCIB is directed onto a substrate. The beam is deflected electrostatically in a raster pattern.

The Office Action states the following:

> "Fig. 4 depicts the gas cluster ion beam [64] impacting the semiconductor substrate [52] by sweeping at different trajectories that can be repeated. Fig. 4 also depicts that the gas cluster ion beam [64] is projected at an initial incident angle of 0º, where the trajectories of said gas cluster ion beam [64] appear to be swept at a different angle less than 90º."

As an initial matter, the Office Action seems to refer to the same angle in different terms, sometimes referring to it as 0º and sometimes referring to it as 90º. The Applicants believe this discrepancy is due to a simple typing mistake but it is important to point out this discrepancy to clarify that there is only one incident angle that is disclosed in Erickson, namely, one that is normal to the surface.

The GCIB apparatus illustrated in Fig. 4 and described in Erickson is a conventional GCIB apparatus. It is well known that this apparatus emits GCIB and irradiates surfaces at normal angles or angles very close to normal. The "trajectories" mentioned in the Office Action are merely small deflections needed to scan the beam in a raster pattern. This is clearly stated in the text that is cited in the Office Action.

The Office Action refers to an "<u>initial</u> angle" (emphasis added) but there is no other angle disclosed or suggested in Erickson. The Office Action indicates that the "trajectories of said gas cluster ion beam appear to be swept at a different angle less than 90º"without explaining what in Erickson is thought to make this apparent. The Applicants can only guess this allegation arises from what is illustrated in Fig. 4. In the figure, a GCIB is shown to impinge on a surface at an angle that

is not normal. If this is the basis for the allegation, then the Applicants strongly disagree and submit that the figure is merely a schematic illustration of known apparatuses that irradiated surfaces with GCIB at normal angels. While the electrostatic deflections mentioned in Erickson do change the angle of incidence, these changes are very small and result in an angle of incidence that is essentially equal to normal at all times. The person of ordinary skill in the art would not understand Erickson to disclose irradiation angles that depart significantly from normal.

Referring to page 15, the Office Action alleges that it would have been obvious to replace the "single trajectory of Matsukawa [sic, Hoehn]" with the "different trajectories" in Erickson. This statement mischaracterizes the art. As explained above, the "trajectories" mentioned in Erickson are merely the orthogonal deflections needed to effect a raster scan of the GCIB. The GCIB apparatus that is referred to in Hoehn and the other primary references is the same type of apparatus. Erickson does not add any relevant teaching to what is disclosed in Hoehn and the other primary references.

Finally, even if Erickson or Dykstra did disclose significant variations in incident angle, it would be incorrect an unfounded to conclude that such a teaching would render obvious the use of irradiation angles that the prior art taught would result in increased roughness.

Claims 4-5 (New Claims 16-17)

The Office Action indicates Dykstra and Erickson disclose the features of claims 4-5 that are not recited in the principal references, and that it would have been obvious to combine teachings to obtain all that is claimed. The Applicants disagree.

New claims 16-17 correspond to claims 4-5. Features in these claims are recited differently to overcome the rejection made under § 112. The methods of these claims irradiate a solid surface with GCIB in two different orthographically-projected directions. The method of claim 17 also varies the direction continuously.

Neither Dykstra nor Erickson disclose these features.

The Office Action indicates that Hoehn discloses one direction and Dykstra discloses a different direction but these refer to features that are not pertinent to what is claimed and, furthermore, are unrelated to one another. The "direction" referred to in Hoehn is an incidence angle and the "direction" referred to in Dykstra is an offset angle of the GCIB unrelated to incidence angle. In any case, neither corresponds to the directions set forth in the claims.

The Office Action indicates that Hoehn discloses one direction and Erickson discloses a different direction but these refer to features that are not pertinent to what is claimed. The "direction" referred to in Hoehn is discussed above. The "direction" referred to in Erickson is not

understood. The Office Action indicates Erickson discloses "sweeping to a different (i.e. second) direction" but the Applicants are unable to find anything in Erickson that is even remotely similar to what is alleged. The Applicants respectfully submit that neither reference discloses anything that corresponds to the directions set forth in the claims.

Claims 6-8 (New Claims 18-21)

New claims 18-21 correspond generally to claims 8, 6, 8 and 7, respectively. They all depend on at least one of the claims discussed above and recite further limitations. The arguments set forth above apply to these claims.

New Claims 22-24

The Applicants also present new claims 22-24.

Claim 22

The method of claim 22 comprises "a step of irradiating the solid surface with the gas cluster ion beam with an irradiation angle between the solid surface and the gas cluster ion beam being less than 30° for at least a portion of a time period of gas cluster ion beam irradiation so that the solid after irradiation has a thickness greater than or equal to 10 nm."

Regarding claim 22, the Applicants have instructed the undersigned to submit the following:

The value of 10 nm represents a reachable depth of the clusters of a GCIB. The resultant solid that has been smoothed by the claimed method has at least a thickness of greater than or equal to the reachable depth in order that the resultant solid shall have a domain in depth direction in which there is no damage by the intrusions of the clusters after the smoothing. Hoehn requires the bond between fullerene molecules and a substrate (fullerene-to-substrate) that is stronger than the bond between fullerene molecules (fullerene-to-fullerene). That is, Hoehn turned his attention to the difference in bonding force of the two types of chemical bonds and discloses the thin coating layer forming technology in which a beam generator produces a beam arranged to break the weaker fullerene-to-fullerene intermolecular bond of a multilayer coating but inadequate to break the stronger fullerene-to-substrate bond of the coating. As a result, it removes layers of the multilayer coating but leaves an approximate monolayer coating of fullerene molecules on the substrate.

In contrast, because the resultant solid that has been smoothed by the method of claim 22 has a thickness of 10nm, which is significantly greater than the thickness of a monolayer of atoms or molecules, the resultant solid produced by the claimed method clearly differs from that of Hoehn.

Because the actions of the clusters of a GCIB to the solid do not reach beyond a depth of 10 nm below the surface in the claimed method, the actions occur inside the solid where only the bond

between atoms composing the solid (solid-to-solid) exists. This means the method of claim 22 does not utilize the bond between a substrate, which is composed of a different material than the solid in Hoehn, and atoms composing the solid (substrate-to-solid). This differs from what is disclosed in Hoehn. Please note that in the claimed method the distinction between the substrate and the solid is not required.

The method recited in claim 22 also is not obvious from Hoehn. First, Hoehn does disclose a technique to make a monolayer coating of fullerene molecules on a substrate using the bond of fullerene-to-substrate that is stronger than that of fullerene-to-fullerene but it is not a technique to smooth a surface of a solid. As described in paragraph [0029], Hoehn acknowledges that establishing the presence of an absolute single layer is problematic. Thus, if the technique by Hoehn is applied to a solid of multilayer film that has an extremely even surface in an initial state, the resultant surface roughens in comparison to the initial state.

Second, the experimental facts disclosed by Hoehn do not establish the smoothing effect based on the irradiation of a solid with a GCIB at an angle less than or equal to 30 degrees. In light of the technical knowledge that was discovered by the Applicants, one can readily predict that the roughness of a surface of a multilayer coating of fullerene molecules with a considerable depth decreases by being irradiated adequately with a GCIB at an angle of from 25 to 30 degrees. On the other hand, according to Hoehn, layers of the multilayer coating are removed leaving an approximate monolayer that combines with a substrate strongly, and the smoothing effect is not realized in this removal process. Therefore, at the time Hoehn was filed, one of ordinary skill would have predicted that the irradiation of a GICB at an angle of from 25 to 30 degrees, which Hoehn specified, to a solid having a thickness in which the bond of substrate-to-solid did not exist increased roughness of the surface of the solid rather than decreased the roughness, just as Kitani discloses. Even now, one of ordinary skill in the art would predict the same.

Claims 23-24

The methods of claims 23-24 recite features and characteristics of a sold surface that differ from what is disclosed in Hoehn. The difference of the bonding strength between the fullerene-to-substrate molecules and the substrate-to-substrate molecules that is required by the method in Hoehn does not exist. As a result, there would not have been any obvious reason to apply the teachings from Hoehn to the recited surface because there would not have been any expectation that the Hoehn method would work.

CONCLUSION

Applicants amend the specification, claims and drawings, and request reconsideration in view of the discussion set forth above.

Respectfully submitted,

David N. Lathrop
Reg. No. 34,655
No. 827
39120 Argonaut Way
Fremont, CA 94538
Telephone: (510) 713-0991
Facsimile: (510) 474-1643

Enc. Replacement drawings
Annotated drawings showing changes
Information Disclosure Statement

Certificate of Transmission

I certify that this Response to Office Action and all accompanying materials are being transmitted electronically on May 23, 2011 to the U.S. Patent and Trademark Office (USPTO) via the USPTO electronic filing system (EFS-Web).

David N. Lathrop